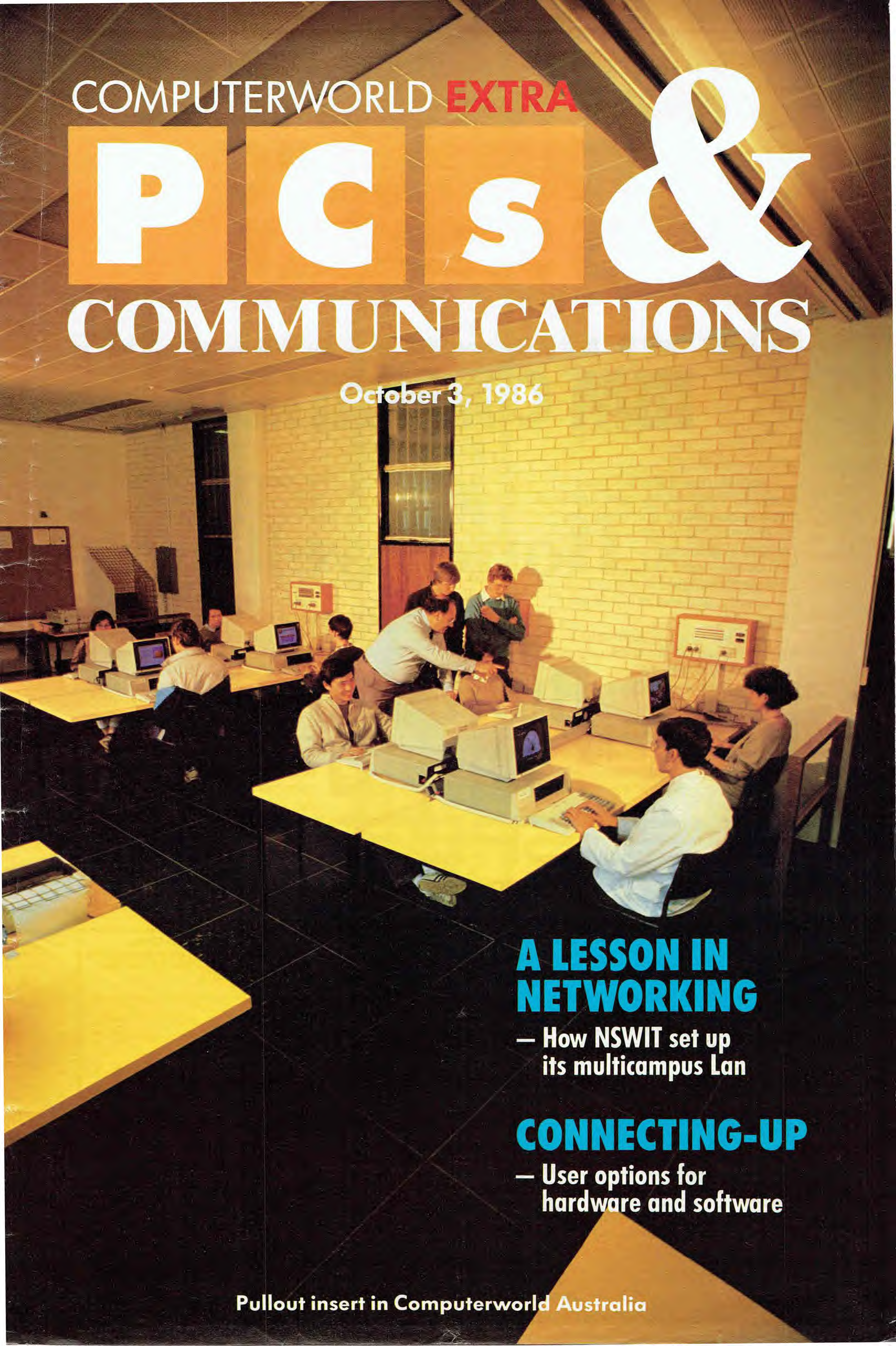
COMPUTERWORLD EXTRA

PCs & COMMUNICATIONS

October 3, 1986



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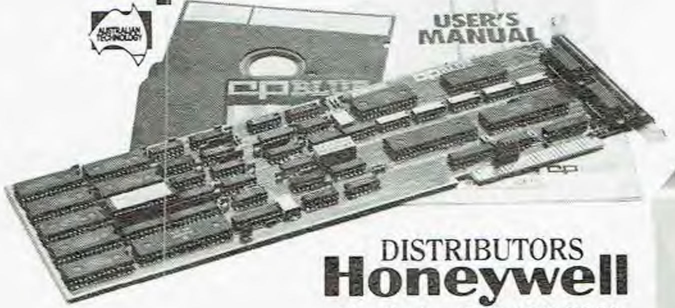

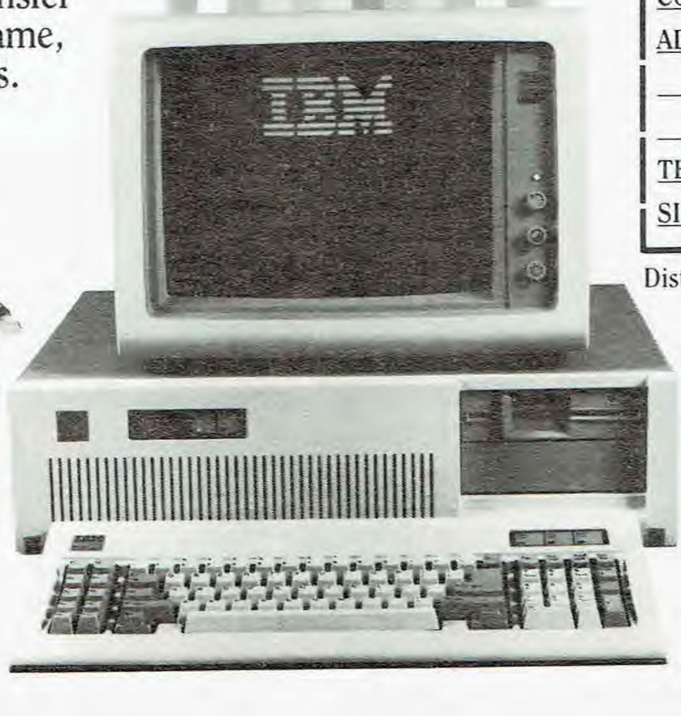

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LESSON IN NETWORKING

Institute points the way with massive multi-vendor installation

The issues faced by the New South Wales Institute of Technology during the transition from a single batch computer system to a complex network environment are examined by Dr Fergus O'Brien, formerly of the School of Computing Sciences. He describes three complementary strategies. The current environment includes a dual Honeywell L66/60 computer as the main academic and administrative system. This is linked to a star network of terminals, and to an Ethernet local area networks. The environment also includes a variety of minicomputers and some 200 micros.

THE COMPLEXITY of the systems used by the NSW Institute of Technology has changed markedly since 1978, which saw the initial installation of the Honeywell Level 66/60 replacing an ICL 1904A.

The institute now has significant systems from five different manufacturers, a variety of minis, some 200 micros and a multi-campus local area network (Lan). This article outlines the strategic issues that have both prompted these developments and also shaped the developments themselves.

There are three primary characteristics that determine the environment for planning purposes.

- The institute's objectives are concerned with the vocational education of tertiary level students and applied research. The objectives imply that educational methods and equipment must be up to date and relevant to Australian employers.
- Financing is virtually all from the Federal government via the State Government, and is inevitably severely restricted. In real terms the size of the pot is steadily decreasing, and the percentage directed to computing is relatively constant.
- The organisation of the institute consists of two administrative divisions and eight academic faculties. Central facilities consist of the computer centre and the library. Decision making is by a form of consensus, rather than by central direction, so that "advice" is the strongest control technique available.

The issues facing senior management are primarily a result of the opportunities and constraints inherent in the institute's environment. One major feature that any planner has to face in tertiary education is a lack of flexibility in both acquiring and assigning resources. This is in contrast to the situation in commerce and industry, where a reasonable degree of flexibility exists.

The issue may be directly related to the objectives of the institute:

- The first issue is provision of "state of the art" and representative equipment for 8500 students. One of the most interesting aspects of information technology is how it is beginning to pervade every educational domain. Direct examples are in law, accessing legal databases, and in social science, with journalism. Less direct examples are in chemistry for simulating experiments, and in literature for concordance and style studies.
- The second issue is the allocation of funds within the institute to computing and communication facilities. There are a variety of competing priorities across the vocational spectrum, such as theodolites for surveyors and fume cupboards for chemists, priorities that cannot be gainsaid. Inevitably, critical priorities emerge such as the handling of blood in Life Sciences following the discovery of Aids.
- The third issue is possibly the most interesting; that of control. An institute does not have a profit motive and cannot hire

(Continued page 4)

Dr Fergus O'Brien, formerly with the School of Computing Sciences at NSWIT, is chief scientist, applied research and development, with Computer Power. He is also a member of the course advisory committee at NSWIT's Key Centre for Advanced Computing Sciences featured on the cover of this publication.

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A PUBLICATION OF COMPUTERWORLD

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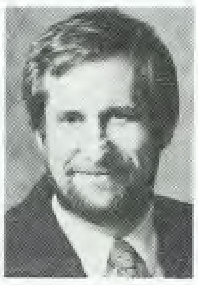

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PC communications can be broken down into three main areas. Many hardware and software options are available for each of the three. Des Kennedy analyses a bewildering market.

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21 Micro mania

Amy Wohl says there has been a pause in microcomputer mania, but it is a pause that will refresh. In fact, she says, the market is awaiting the next generation of products.

COMING SOON

Four more Computerworld Extras are planned for this year. On Printers will be inserted in the edition of October 17, On Pick on November 24, On Government on October 31, and On Artificial Intelligence on November 7. Editorial submissions are welcome and should be discussed with Mike Harrison on (02) 439 5133.

How a campus beat the network blues

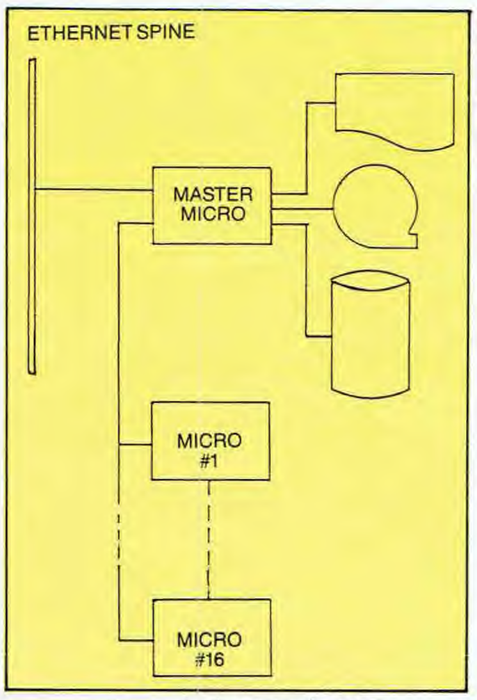


Figure 1: A micro cluster.

(Continued from page 3)

and fire staff, particularly tenured staff. Each faculty or division is a fiefdom, fiercely guarding its own territory, both functionally and in terms of budgets. The management structure is a set of advisory committees, the most powerful being the President's Advisory Committee, on which all the clan leaders sit. The implication, and practice, is that control cannot be exercised directly, nor influence be too blatant.

Until 1980 the general strategy was based on a central complex with an increasing number of terminals forming a star network. Planning for a replacement central system worked on a crisis approach, envisaging a total change of system every 10 years or so.

The picture changed significantly in 1979 with the advent of powerful minicomputers and the introduction of Visicalc on the Apple II. The changes meant it was possible to economically acquire systems for dedicated or specialised use, and in the micro area it was possible to buy trial machines without risk.

Clearly the institute wished to provide the spectrum of systems from mainframes to micro, to satisfy the marketplace objective. Equally, the specific application expertise rested with the appropriate faculty. But a trial period was needed to demonstrate that faculties could also support dedicated minis or micros, as well as use them.

The last part of the computer strategy then became the policy of providing a viable and continuing central facility, with encouragement for academic and administrative units to examine optimised systems, either minis or micros, to meet their own requirements. The policy was taken up enthusiastically, and the institute suddenly became flooded with micros, mainly Apple IIs.

The second part of the policy was to formalise a network approach to tie together all the systems, at least in principle. This policy was partly driven by the need to provide geographic access to faculty systems, such as the Faculty of Engineering's Vax, at minimal cost. The network policy required that any system be capable of being hooked into the network, at least at the Ethernet level.

An extension to the simple network policy has been to advise that groups of micros should themselves be networked, with a master micro containing the file and print server plus Ethernet connection, (see Fig 1). The resulting assembly of systems, in a somewhat sanitised form is shown in Fig 2.

Two systems that should be noted are the Xerox Laser Print Facility and the Clann online public access catalogue (Opac) system. The intention with the laser printer is to provide an institute-wide phototypeset-quality print facility, with eventual installation of cheaper laser printers in the faculties and divisions.

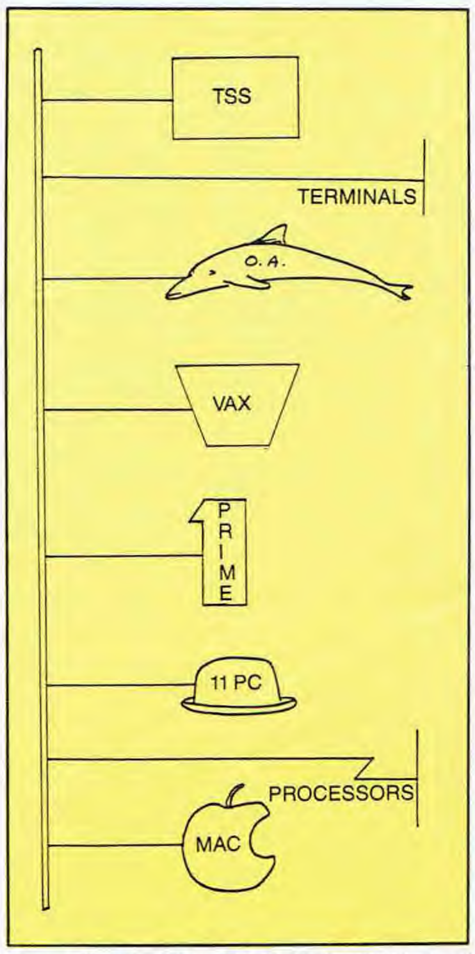
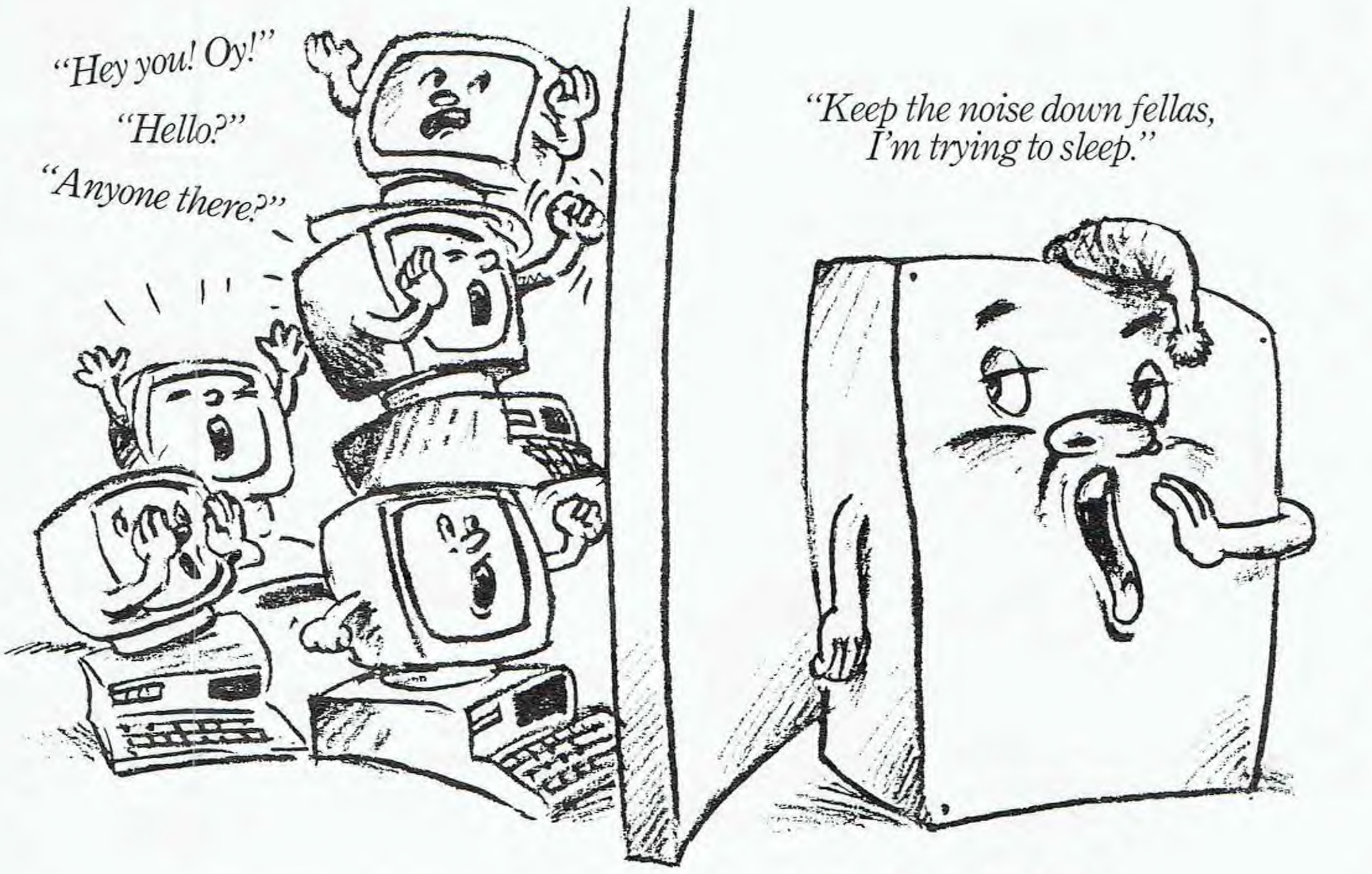


Figure 2: The New South Wales Institute of Technology systems.

The Clann Opac runs on a Geac system. Network access was a major determinant in the selection of this system.

A major problem for funding a central facility in times of general hardship is that the percentage of annual capital funds is usually the biggest single identifiable item, some 30 per cent of the total. Despite general usage of the central facilities, it is often seen as a computer centre vote.

In practice the demand for dedicated facilities can be offset against a reduced demand for experimental facilities in say, Physics, or for clerical support. The financial strategy is therefore to limit the central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Rapid switch from basic batch system

facilities to the provision of an overall processing resource, plus the network.

It is then the financial responsibility of the faculties and divisions to provide for their own terminals and connectivity to the network, in addition to funding their own dedicated processors.

This is not an undue imposition on the faculties, as the use of a dedicated micro is less than 30 per cent occupancy; the rest of the time it can be used as a terminal, saving not only multiple purchases but also excessive demands for building space.

The financial strategy is therefore to spread the load to match the growth of dedicated facilities, but to balance this against the requirement to maintain a viable central facility, (computers and network).

The almost uncontrolled proliferation of Apple II's and the large overruns on some dedicated installations indicated that there were significant resource and other risks involved in distributing control. Underestimation of total costs to reach a viable configuration was one factor, duplication of facilities another, and the spectre of a combinational explosion in micro software licences a further factor.

The attempt to bring a modicum of control began with the writing of a five-year plan to commence in 1983. The plan is a rolling plan in the sense that it aims to replace central facilities over the period in such a way that future changes may continue to be made on a year-by-year incremental basis.

The plan covered five central elements office automation, general administration, basic and complex academic computing, and the network infrastructure. The plan also envisaged and encouraged growth in dedicated mini and micro facilities.

The next stage was to generate a favored list of microprocessors. The IBM PC range and the Apple Macintosh were at the top of the list. The last stage was to promulgate a policy on the preferred means of acquiring micros, covering clusters, network interfacing and software considerations.

In effect, a school or division can buy any form of system as long as its displays can be used as network terminals, and file transfer is also possible in both directions.

This combination of plans and policies is administered through the institute's Tender Board in conjunction with the Computer Advisory Committee.

The institute has moved rapidly from a simple batch system to a complex of mainframes, minis and micros, with an underlying network infrastructure.

The advisory mode of management has meant that a set of strategies has had to be devised that allows the development of effective systems for operating units within severe budgetary constraints. The key techniques are to promulgate a rolling five-year plan which ensures that any system can interact with the network infrasturcture.

Our feeling is that we are hanging on by our fingertips. Most purchasers of systems in the institute are happy to seek and accept advice; the difficulty is then to ensure that adequate network services are available for their systems to interface to.

● *This article has been edited from a paper presented to the HLSUA Forum.*

Is the IBM PC really obsolete?

FIVE YEARS after the announcement of the IBM Personal Computer, a debate rages over the usefulness of the original technology.

For many, the IBM PC is obsolete, and they will settle for nothing less than an IBM AT or compatible with the more powerful Intel 80286 microprocessor. Others gnash their teeth in anticipation of a micro based on the powerful Intel 80386 microprocessor.

The introduction of hard disk drives that fit into one of the PC's expansion slots and accelerator boards that boost its speed to the rate of an IBM PC AT have also helped to keep the PC competitive with newer machines.

"The initial target for the hard disk device was the old full-height IBM PC," says Ian Warhaftig, International Data Corp (IDC) senior market analyst in its storage products program. IDC expects 230,000 of these devices to be shipped this year, many of them going into the older floppy disk-based PCs.

Many companies still buy what amounts to the original IBM PC with a hard disk drive. "We buy more Personal Computer XTs or XT equivalents than anything else. The hard disk is more important to us now than the faster (80286) processor," said Bruce Johnson, manager of the resource centre at Deloitte Haskins & Sells.

"There are even some employee situations where they are buying just a floppy-based machine," Johnson said.

In early 1985, IBM announced a floppy disk-based version of the PC XT with a PC XT motherboard that allows the machine to be more easily outfitted with a hard disk drive. This machine costs little more than the PC and has effectively stopped plain PC sales dead in their tracks.

Many viewed the 1984 introduction of the IBM PC AT as the end of the road for the IBM PC. But the lack of an operating system that unleashes the full power of the AT class of machines has kept the Intel 8088-based machines in the running a situation that many lament.

IBM has clearly dominated the market for PCs and claims to be surprised by its early success. "IBM made projections that it would sell so many (PCs) in the life of the machine, and they blew those projections out of water in the first year," said Frea McNeese, an IBM spokesman.

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WORKS 1292

Broad options in software and hardware

By Des Kennedy

● *Des Kennedy is a senior consultant with Housley Communications Consultants Pty Ltd. He specialises in the designs of networks, cost optimisation, selection of common carrier services, network performance analysis and communications hardware and software evaluation. This article has been edited from a paper presented to a recent Computerland industries update seminar.*

PC COMMUNICATIONS involves the use of telecommunications to enable a PC to communicate with a range of public databases, host computers or other PCs over both private and public networks. PC communications can be broken into three major areas, although these overlap to some extent.

- Wide area communications (Wans), based on use of public networks to communicate with a range of public and private computers at any distance.
- Local area networks (Lans), using a private network to interconnect PC's, hosts and peripherals at high speed within a single building or group of buildings.
- Host gateways, communicate with host computers through terminal emulation of file transfer.

Many hardware and software options are available for each of these areas. PC users should be aware of all these options in order to decide which is the best implementation for particular requirements.

PC communications is based on data communications technology which has largely been developed to meet the requirements of mainframe computers. It is necessary to understand the basics of data communications before considering the PC technologies in any detail.

This paper provides an overview of data communications developments, and of ways these have been adopted by the new technology of PCs.

Synchronous vs. Asynchronous: Two common methods of identifying the characters formed by bit groups are used: asynchronous transmission, where each character is handled separately, and synchronous transmission, where characters are grouped into blocks.

Cheapest method

An easy way of understanding the difference between these types of transmission is to regard asynchronous transmission as individual cars driving down a road, synchronous transmission is represented by a train.

Asynchronous transmission was the first method used to identify individual bit groups in data communications, and is still used for most PC communication today. It is both the cheapest method, and practically all PCs are provided with an asynchronous port following the RS232C or V.24 standard.

Despite its simplicity and low hardware costs, asynchronous transmission is inefficient. It requires 10 or 11 bits to be transmitted for each eight data bits, a data throughput of only 72 per cent of total bandwidth.

Synchronous transmission overcomes this inadequacy by transmitting data characters in blocks without intervening start and stop bits. This efficiency requires more complex and expensive hardware, but is now becoming increasingly common for PC communications, particularly where efficiency is of great importance, such as file transfers, host communications, and Lans.

Communication is rarely a one-way flow, either for voice or data, and different method are used for communicating bidirectionally. When people converse normally, one person talks at any time and the

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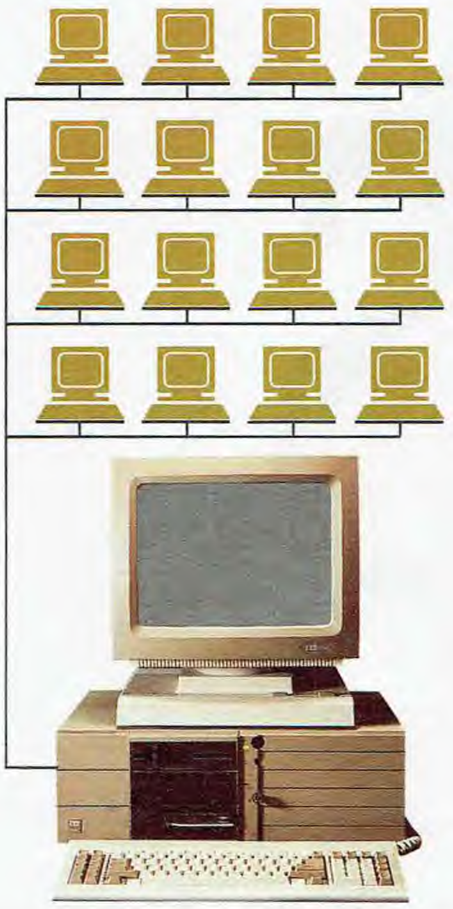

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others listen, and then talk in turn.

This is known as half-duplex communication and is used for data communications when a line can only provide communications in one direction at any one time. Full duplex communication is when both parties can talk and listen simultaneously.

The RS232C or V.24 interface is the most common for personal computers, and is available for all types of PC. RS232C was originally developed for connecting computer terminals to modems, but has since been adapted to a range of functions.

The full RS232C interface has 25 pins to support the full complement of modem functions. But other connections can often make do with only a few pins (Fig 1).

Major pins of the RS232C interface

- **Ground:** All signals are voltages measured against ground.
- **Transmit Data** (TD), **Receive Data** (RD): These are actual bit streams for the transmit and receive data. As these were designed to be "straight through" when connecting a terminal or computer to a modem, they often have to be crossed over when connecting a terminal to a computer, as do the other "paired" signals described below.
- **Data Terminal Ready** (DTR), **Data Set Ready** (DSR): These signals indicate that the terminal and modem respectively are powered on and operational, but not necessarily ready to exchange data.
- **Request To Send** (RTS), **Clear to Send** (CTS): Indicated when the terminal has data to send and the modem is able to transmit data.
- **Transmit Clock, Receive Clock:** Used when the transmit and receive data signals need clocking, usually for synchronous data, less often for asynchronous.

Fig 1: The major pins of the RS232C interface.

When connecting any devices via an RS232C cable, it is important to use the correct type of cable. The RS232C interface is not a true standard, and many interface variations exist for different equipment.

Two major classes of cable exist: straight-through cables used to connect a PC or peripheral (DTE) to a modem (DCE), and crossover cables used when connecting a PC or peripheral (DTE) to another DTE.

Crossover over cables swap over signals such as Transmit and Receive Data and Data Terminal Ready and Data Set Ready. Trial and error is often needed in making up a crossover cable. This can be helped by using a breakout box which enables cross connections to be made easily.

So far, the most common medium for wide area data communications has been the public switched telephone network (PSTN). The telephone network reaches practically everywhere, but was designed specifically for voice rather than data traffic, and cannot carry digital signals directly.

This restriction is overcome by using modems, which modulate the digital signals used in data communications into tones which can be carried successfully over the telephone network and then demodulate them back into digital signals at the other end.

Modems have been adopted enthusiastically for PC wide area communications, as both flexible and cost-effective for the limited amount of communication normally carried out by PCs.

Developments in integrated electronics which have led to the power and low cost of PCs have also been applied to modems, leading to the new-generation of "smart" modems. These can be controlled by software in the PCs, and have made modem communications much easier.

Because the telephone network was never designed for data communications, it offers only limited speed and reliability for data traffic. So special data networks have been developed, including the Digital Data Service and Austpac in Australia. These can be accessed equally well by PCs and mainframe computers.

Complex modems

Different modem standards have been developed over the years to provide a range of transmission speeds for both half and full duplex communications. Within Australia the CCITT V. series standards are used. Most common PC communications are:

- V.21: 300 bits/sec asynchronous, full-duplex. These modems are simple and inexpensive and often used for bulletin board systems.
- V.23: 1200/75 bits/sec asynchronous, split speed fully-duplex, often used for enquiry/response networks such as Viatel, where keyboard enquires can be handled by a lower speed (75 bits/sec) than the response (1200 bit/sec).
- V.22: 1200 bits/sec synchronous and asynchronous, full duplex. These are becoming the most common standard for access to networks such as Minerva and for PC-PC file transfers.
- V.22bis: 2400 bits/sec synchronous and asynchronous, full duplex. These modems are complex and still relatively expensive; mostly used where frequent connections must be made at STD or ISD rates. Enabling their greater speed can help pay for themselves by shorter calls at lower costs.

Communications packages are available for virtually all PCs, and make wide area modem communications relatively straightforward. Packages vary in sophistication and complexity, but typically control the connection to a number of different destinations automatically, and provide terminal emulation and file transfer when a connection is established.

Communications packages are either standalone (Crosstalk and Mite) or integrated into a multi-function package, such as Framework or Lotus 1-2-3 Release 2.

When a number of PCs are grouped in the same organisation, the ability to communicate locally offers many advantages through sharing of data files, programs and expensive peripherals such as letter quality printers and modems.

Local area communications is best handled by a local area network, (Lan). Lans enable clusters of PCs to share common disk files and peripherals using file and print serv-

(Continued page 10)

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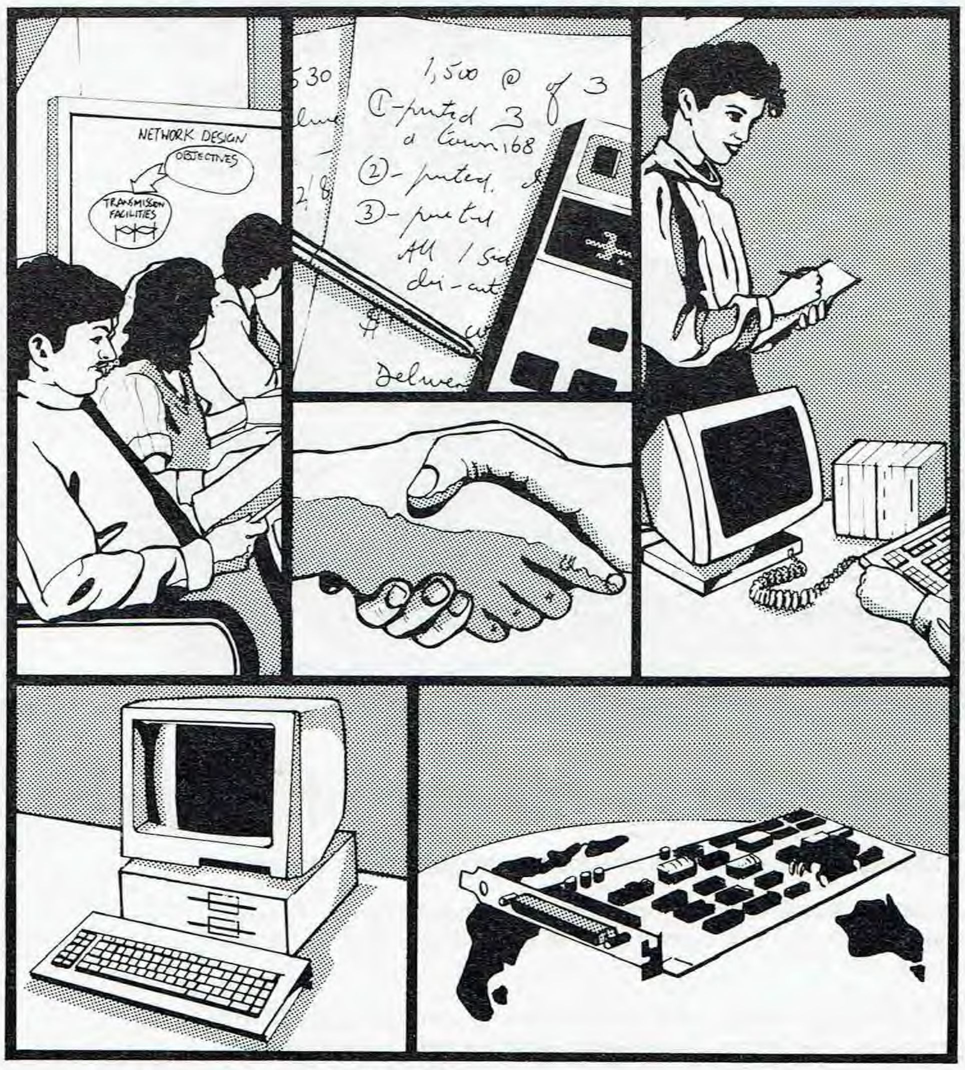
The Declaration of Interdependence

The SNS Group of Companies provides a comprehensive range of computer systems, software and communications links for any business, from a sole trader to Australia's largest corporations and government departments.



HARDWARE

We are exclusive Australian distributors of a comprehensive range of hardware systems, including:

Convergent Technologies
Our Hero system provides up to 16 users with this multi-terminal system in the office automation environment. Operating systems include CTOS, HOS and MS-DOS.

Our Hero can be fully expanded to connect up to 128 units, sharing files and peripherals, with gigabytes of storage capacity.

Leading Edge PC
Currently the fastest selling compatible PC in the USA. It is designed especially for business, with twin disk drives, fully expanded memory (640K), graphics and printer ports designed into the motherboard. A range of software is included in the price.

Leading Edge is also available with a 30 megabyte internal hard disk – the only PC XT which offers this much storage as standard.

Peripherals
A comprehensive range, including industry standard printers (letter quality, matrix, ink-jet and laser), hard disk drives, streaming tapes, diskettes for both CT and PC systems, Microsoft Windows and Mouse.

Add-on Cards
Exclusive distributors of a range of expansion cards for all industry standard PCs. Our 286 half-length boards offer PC AT performance on your standard PC.

SOFTWARE

We specialise in an extensive range of systems and application software for the office, including word processors, spreadsheets and database management systems. Systems programming and special applications programming are also available.

- **Convergent Technologies**

R:BASE
Comprehensive relational database management system.
TELEX MANAGEMENT
Manages the generation, despatch and receipt of telex messages throughout a CT cluster/network.
VIATEL ACCESS
Offers colour or monochrome access to Telecom's information database.
SYSLOG
Allows cluster/network supervisors to monitor system activities by individual users.
MULTIPLAN CONSOLIDATOR
Identical models are consolidated into a new model whose numerical fields contain the sum of those from the originating sheets.
MdEXEC
User-definable menu executive.
WINDOW WIZARD
Brings a handful of desk accessories (clock, diary, calculator) to your screen.
VIEW IT
"File dump on screen" utility.
PASCAL ANIMATOR
Interactive debugging facility operating at Pascal source line level.

- **PC applications**

R:BASE 4000 and 5000
The popular comprehensive relational database management system.
MOSAIC
Integrated software for your PC, combines seven activities: WP, spreadsheet, database, datamail, terminal emulation, graphics and communications.
LIGHTNING
Runs PC applications up to four times faster that standard.
DISK OPTIMISER
Clears disk fragmentation.
CUBIT
Creates free space on full disks.
CAROUSEL
Allows up to 10 partitions on your PC.
DOUBLE DOS
Allows MS-DOS to be loaded on two partitions to run concurrently.

COMMUNICATIONS

We are communications specialists, supporting a range of hardware and software comms systems as well as creating specialist set-ups for individual needs.

- **PCtos-NET**

At last! Your CT system can share files with the IBM PC or PC compatible, including Leading Edge. A communications breakthrough for offices which already have both systems installed. Share Multiplan files, convert Lotus 1-2-3 for transfer and massage on your high-speed CT system.

- **Honeylink**

Add-on board gives your PC a direct link with Honeywell mainframes.

- **Waterloo Port**

Direct peer-to-peer networking for your PCs. Avoids the dangers of a crash on a file server or a break in token rings.

EDUCATION

A full range of hands-on training for users, with detailed courses on operating systems (CTOS, BTOS, HOS, MS-DOS), system software, utilities, networking, system administration and applications, including popular packages such as Lotus 1-2-3, Multiplan and dBase III.

We can bring our classes to your site or teach in our fully equipped head office in Sydney. Our courses are designed to get rid of computer jargon so that they are both comprehensive and easy to follow.

We cater for everyone from beginner to advanced users in one-to-one training or group courses that meet your individual needs and timeframe.

SNS supports all purchases with extended warranties, service facilities, hotline support and advice on our toll-free number. We can offer pre-purchase advice on office ergonomics, system design and special user requirements including software designed to your company's special needs.

SNS Group of Companies

Our independence is your insurance

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